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In re Patent Application of: Mary Michelle Quinton
Title: PLUGGABLE TERMINAL ARCHITECTURE FOR TAPI
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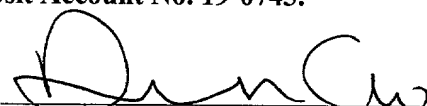
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UNITED STATES PATENT APPLICATION

PLUGGABLE TERMINAL ARCHITECTURE FOR TAPI

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MICROSOFT 113086.3

PLUGGABLE TERMINAL ARCHITECTURE FOR TAPI

Related Applications

This application is a continuation-in-part of U.S. Serial No. 09/157,469, filed September 21, 1998, entitled "Computer Telephony Application Programming Interface," currently pending. U.S. Serial No. 09/157,469 is incorporated herein by this reference and is not admitted to be prior art with respect to the present invention.

Technical Field

This invention relates generally to computer telephony, and more particularly to an application programming interface for computer telephony.

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Background

With the advent of computer networking, such as local-area networks (LAN), wide-area networks (WAN), intranets and the Internet, several applications have become popularized. In one such application, a user of a first client computer is able to "call" and communicate with a user of a second client computer. This type of application is generally known as computer telephony.

To accommodate computer telephony, operating systems such as versions of the MICROSOFT WINDOWS operating systems include telephony application programming interfaces, or TAPI's. (It is noted that TAPI typically refers specifically to Microsoft's Telephony API and is not usually used in reference to other telephony API's. However, as used in this application, TAPI refers to telephony API's generically.) Application programming interfaces (API's) are interfaces by which computer programs can provide for specific functionality that is included within the operating systems. This means that programmers developing such programs do not have to develop their own code to provide this functionality, but rather can rely on the code within the operating system itself. Thus, a TAPI relates to a computer telephony application programming interface.

In the MICROSOFT WINDOWS 95 operating system, as well as other versions of the MICROSOFT WINDOWS operating system, TAPI version 2.1 provides for some basic computer telephony functionality for utilization by computer programs. In particular, TAPI 2.1 provides for call control -- the initiation and termination of computer telephony calls. However, call control is only one aspect of computer telephony. For example, once a computer

telephony call is placed, the media aspects of the call must also be controlled. However, TAPI 2.1, as well as other prior art telephony API's, do not provide for this functionality.

The media aspects of the call relate to the information (or, media) that is itself the subject of the call. For example, a voice call includes audio information transmitted by both the caller and callee of a call, a video call includes both audio information and visual (video) information, etc. Currently, any multimedia devices that are to be used in conjunction with a computer telephony call -- such as microphones to detect sound, and speakers to play sound -- must have specific drivers written for this purpose, to be used specifically in conjunction with computer telephony calls. Other multimedia devices that may be present, in other words, may not be usable in conjunction with the call.

TAPI 2.1, as well as other prior art telephony API's, are also represented as a framework that is not easily expanded. For example, TAPI 2.1 is procedurally based, which means the API cannot easily accommodate new aspects and features without redeveloping the entire API. For the reasons outlined in this background, as well as other reasons, there is, therefore, a need for the present invention.

Summary

The above-identified problems, shortcomings and disadvantages with the prior art, as well as other problems, shortcoming and disadvantages, are solved by the present invention, which will be understood by reading and studying the

specification and the drawings. In one embodiment, a system includes at least one call control object and at least one media control object. The call control objects are to initiate and terminate a computer telephony call having a media stream. The media control objects are to end-point the media stream of the computer telephony call. In a further embodiment, there is also a media control manager to instantiate a media control object for each multimedia device of the system.

Thus, embodiments of the invention provide for advantages not found in the prior art. The invention provides for well-defined media control: besides call control objects, embodiments of the invention include media control objects to end-point (for example, source or sink) the media stream of a computer telephony call. The invention provides for the utilization of multimedia devices (including virtual devices as well as physical devices) that may not have been installed specifically for telephony purposes, via the media control manager instantiating media control objects for such devices. Furthermore, the invention provides for an object-based hierarchy to TAPI's (e.g., via the call control objects and the media control objects), to maximize flexibility and further expansion of TAPI's based on the invention.

The invention includes systems, methods, computers, application programming interfaces, and computer-readable media of varying scope. Besides the embodiments, advantages and aspects of the invention described here, the invention also includes other embodiments, advantages and aspects, as will become apparent by reading and studying the drawings and the following description.

Brief Description of the Drawings

FIG. 1 shows a diagram of the hardware and operating environment in conjunction with which embodiments of the invention may be practiced;

5 FIG. 2 shows a block diagram of an object hierarchy according to one embodiment of the invention;

FIG. 3 shows a block diagram of an architecture according to one embodiment of the invention;

FIG. 4(a) shows a method for placing an outgoing computer telephony
10 call according to an embodiment of the invention; and,

FIG. 4(b) shows a method for receiving an incoming computer telephony call according to an embodiment of the invention.

FIG. 5 is a block diagram of a system according to one aspect of the present invention.

15 FIG. 6 is a block diagram of a system according to one aspect of the present invention.

FIG. 7 is a block diagram of two systems according to one aspect of the present invention.

FIG. 8 is a block diagram of a system according to one aspect of the
20 present invention.

FIG. 9 is a process diagram of a method according to one aspect of the present invention.

FIG. 10 is a process diagram of a method according to one aspect of the present invention.

FIG. 11 is a process diagram of a method according to one aspect of the present invention.

FIG. 12 is a process diagram of a method according to one aspect of the present invention.

5 FIG. 13 is a process diagram of a method according to one aspect of the present invention.

FIG. 14 is a process diagram of a method according to one aspect of the present invention.

10 FIG. 15 is a process diagram of a method according to one aspect of the present invention.

FIG. 16 is a structural diagram of a data structure according to one aspect of the present invention.

FIG. 17 is a structural diagram of a data structure according to one aspect of the present invention.

15 FIG. 18 is a process diagram of a method according to one aspect of the present invention.

FIG. 19 is a structural diagram of a data structure according to one aspect of the present invention.

Detailed Description

In the following detailed description of exemplary embodiments of the invention, reference is made to the accompanying drawings which form a part hereof, and in which is shown by way of illustration specific exemplary
5 embodiments in which the invention may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention, and it is to be understood that other embodiments may be utilized and that logical, mechanical, electrical and other changes may be made without departing from the spirit or scope of the present invention. The following
10 detailed description is, therefore, not to be taken in a limiting sense, and the scope of the present invention is defined only by the appended claims.

The detailed description is divided into five sections. In the first section, the hardware and the operating environment in conjunction with which
embodiments of the invention may be practiced are described. In the second
15 section, a system of one embodiment of the invention is presented. In the third section, a method, in accordance with an embodiment of the invention, is provided. In the fourth section, various system, method, and data structure
embodiments of one aspect of the present invention, namely pluggable terminals,
are described. Finally, in the fifth section, a conclusion of the detailed
20 description is provided.

Hardware and Operating Environment

Referring to FIG. 1, a diagram of the hardware and operating environment in conjunction with which embodiments of the invention may be practiced is shown. The description of FIG. 1 is intended to provide a brief, general description of suitable computer hardware and a suitable computing environment in conjunction with which the invention may be implemented. Although not required, the invention is described in the general context of computer-executable instructions, such as program modules, being executed by a computer, such as a personal computer. Generally, program modules include routines, programs, objects, components, data structures, etc., that perform particular tasks or implement particular abstract data types.

Moreover, those skilled in the art will appreciate that the invention may be practiced with other computer system configurations, including hand-held devices, multiprocessor systems, microprocessor-based or programmable consumer electronics, network PCS, minicomputers, mainframe computers, and the like. The invention may also be practiced in distributed computing environments where tasks are performed by remote processing devices that are linked through a communications network. In a distributed computing environment, program modules may be located in both local and remote memory storage devices.

The exemplary hardware and operating environment of FIG. 1 for implementing the invention includes a general purpose computing device in the form of a computer 20, including a processing unit 21, a system memory 22, and a system bus 23 that operatively couples various system components include the

system memory to the processing unit 21. There may be only one or there may be more than one processing unit 21, such that the processor of computer 20 comprises a single central-processing unit (CPU), or a plurality of processing units, commonly referred to as a parallel processing environment. The computer
5 20 may be a conventional computer, a distributed computer, or any other type of computer; the invention is not so limited.

The system bus 23 may be any of several types of bus structures including a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures. The system memory may also be
10 referred to as simply the memory, and includes read only memory (ROM) 24 and random access memory (RAM) 25. A basic input/output system (BIOS) 26, containing the basic routines that help to transfer information between elements within the computer 20, such as during start-up, is stored in ROM 24. The computer 20 further includes a hard disk drive 27 for reading from and writing to
15 a hard disk, not shown, a magnetic disk drive 28 for reading from or writing to a removable magnetic disk 29, and an optical disk drive 30 for reading from or writing to a removable optical disk 31 such as a CD ROM or other optical media.

The hard disk drive 27, magnetic disk drive 28, and optical disk drive 30
20 are connected to the system bus 23 by a hard disk drive interface 32, a magnetic disk drive interface 33, and an optical disk drive interface 34, respectively. The drives and their associated computer-readable media provide nonvolatile storage of computer-readable instructions, data structures, program modules and other data for the computer 20. It should be appreciated by those skilled in the art that

any type of computer-readable media which can store data that is accessible by a computer, such as magnetic cassettes, flash memory cards, digital video disks, Bernoulli cartridges, random access memories (RAMs), read only memories (ROMs), and the like, may be used in the exemplary operating environment.

5 A number of program modules may be stored on the hard disk, magnetic disk 29, optical disk 31, ROM 24, or RAM 25, including an operating system 35, one or more application programs 36, other program modules 37, and program data 38. A user may enter commands and information into the personal computer 20 through input devices such as a keyboard 40 and pointing device
10 42. Other input devices (not shown) may include a microphone, joystick, game pad, satellite dish, scanner, or the like. These and other input devices are often connected to the processing unit 21 through a serial port interface 46 that is coupled to the system bus, but may be connected by other interfaces, such as a parallel port, game port, or a universal serial bus (USB). A monitor 47 or other
15 type of display device is also connected to the system bus 23 via an interface, such as a video adapter 48. In addition to the monitor, computers typically include other peripheral output devices (not shown), such as speakers and printers.

 The computer 20 may operate in a networked environment using logical
20 connections to one or more remote computers, such as remote computer 49. These logical connections are achieved by a communication device coupled to or a part of the computer 20; the invention is not limited to a particular type of communications device. The remote computer 49 may be another computer, a server, a router, a network PC, a client, a peer device or other common network

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node, and typically includes many or all of the elements described above relative to the computer 20, although only a memory storage device 50 has been illustrated in FIG. 1. The logical connections depicted in FIG. 1 include a local-area network (LAN) 51 and a wide-area network (WAN) 52. Such networking
5 environments are commonplace in office networks, enterprise-wide computer networks, intranets and the Internet, which are all types of networks.

When used in a LAN-networking environment, the computer 20 is connected to the local network 51 through a network interface or adapter 53, which is one type of communications device. When used in a WAN-networking
10 environment, the computer 20 typically includes a modem 54, a type of communications device, or any other type of communications device for establishing communications over the wide area network 52, such as the Internet.

The modem 54, which may be internal or external, is connected to the system bus 23 via the serial port interface 46. In a networked environment, program
15 modules depicted relative to the personal computer 20, or portions thereof, may be stored in the remote memory storage device. It is appreciated that the network connections shown are exemplary and other means of and communications devices for establishing a communications link between the computers may be used.

20 The hardware and operating environment in conjunction with which embodiments of the invention may be practiced has been described. The computer in conjunction with which embodiments of the invention may be practiced may be a conventional computer, a distributed computer, or any other type of computer; the invention is not so limited. Such a computer typically

includes one or more processing units as its processor, and a computer-readable medium such as a memory. The computer may also include a communications device such as a network adapter or a modem, so that it is able to communicatively couple other computers.

5

System

In this section of the detailed description, a description of a computerized system according to an embodiment of the invention is provided. The description is provided by reference to FIG. 2 and FIG. 3. Referring first to FIG.

10 2, an object hierarchy according to an embodiment of the invention is shown. The system includes a telephony application programming interface object (TAPI object) 200, an address object 202, a terminal object 204, a call object 206, and a call-hub object 208. For each of objects 202, 204, 206 and 208, only a single object of each type is shown in FIG. 2 for purposes of clarity; however,
15 there can be in one embodiment of the invention multiple instantiations of each of these objects. Each of the objects 202, 204, 206 and 208 may in one embodiment correspond to a specific means for performing functionality of the object.

The interface object 200 provides an interface by which computer
20 programs can access the functionality provided by these other objects. This means that the computer programs themselves do not have to include code for this functionality, but instead can rely on the functionality provided by the objects themselves as already existing, and as interfaced to such programs via the interface object 200. Application programming interfaces within operating

systems such as versions of the MICROSOFT WINDOWS operating system are known within the art.

The address object 202 is a type of first-party call control object. A call control object is an object that provides for the initiation and termination of a computer telephony call having a media stream -- that is, the object provides for the connection and ending of a call. In particular, the address object 202 is an object over which a computer telephony call may be placed. That is, the address object 202 represents a line or device that can make or receive calls on it. In different embodiments of the invention, the object represents a modem attached to a PSTN (Public Switching Telephone Network) phone line, an ISDN (Integrated Services Digital Network) hardware card attached to an ISDN line, a DSL (Digital Subscriber Loop) modem attached to a PSTN phone line having DSL capability, and an IP (Internet Protocol) address that is able to make IP telephony calls. However, the invention is not limited to a particular representation. The address object 202 is a first-party call control object in that it relates to a party of the telephony call -- for example, the caller or callee of the telephony call -- as opposed to a third party not specifically of the telephony call.

The terminal object 204 is a type of media control object. A media control object is an object that end-points the media stream of a computer telephony call. The media stream of a computer telephony call is the information that actually makes up the call -- for example, audio information in the case of a voice call, audio and image (video) information in the case of a video call, etc. A media control object end-points the media stream in that it can be a sink object, which is a finishing end point such as speaker or a monitor

control object in that it does not specifically relate to a particular party of the telephony call, but rather may encompass all the parties of the call (as well as information regarding the call).

Referring next to FIG. 3, a block diagram of an architecture according to one embodiment of the invention is shown. The architecture includes a TAPI application 300, the TAPI 302, a telephony server 304, a telephony service provider 306, a media stream provider 308, and a terminal manager 310. The TAPI application 300 is a computer program that utilizes the functionality provided by the TAPI 302. That is, the TAPI application 300 is any type of computer program that utilizes the TAPI 302, through which the application is able to access telephony call control and media control functionality provided by the TAPI 302.

The telephony server 304 and the telephony service provider 306 make up the call control aspects of the architecture of FIG. 3. The telephony server 304 keeps track of all telephony capabilities on a given computerized system; for example, such as that found within versions of the MICROSOFT WINDOWS NT operating system. The telephone service provider 306 is a component used to control a specific piece of telephony hardware. Although only one provider 306 is shown in FIG. 3, the invention is not so limited; there can be many such providers installed.

The media stream provider 308 and the terminal manager 310 make up the media control aspects of the architecture of FIG. 3. The media stream provider 308 is an extension of the provider 306, and works together with the provider 306 to implement call control (via the provider 306) and media control

(via the provider 308). All call control requests proceed through the telephony server 304 to the provider 306, and all media control requests proceed through to the provider 308. The media stream provider 308 is a component used to control a specific media stream (such as audio, video, etc.). Furthermore, there is a media stream provider 308 for each different media stream; although only one provider 308 is shown in FIG. 3, the invention is not so limited -- there can be many such providers installed.

The terminal manager 310 is a media control manager. It is a component that instantiates a media control object for each installed multimedia device.

That is, it is a component that allows telephony applications (such as application 300) to use any multimedia device installed within a telephony environment.

When the manager 310 is initialized, it discovers all multimedia devices that it can use that are installed on a given computer, such as sound cards, video capture cards, as well as other multimedia hardware; the invention is not so

limited. The manager then creates a media control object, such as a terminal object, for each of these devices. The manager 310 also creates terminal objects or media control objects for other media sources or sink that do not necessarily correspond to hardware, but rather to virtual devices. These types of device represent media stream processing that is performed by the computer itself, rather than specific hardware. For example, these types of terminals may include a video window, a speech recognition engine, and a file; the invention is not so limited.

The TAPI 302 in one embodiment has an interface that defines how the provider 308 communicates with the terminal manager 310. This interface

allows any provider 308 (there may be more than one provider 308, although for purposes of clarity only one is shown in FIG. 3) to query the manager 310 for the devices that are represented as terminal or media control objects. The interface also allows the provider 308 to determine from the manager 310 how to include these devices within media streams that the provider 308 is to set up. Therefore, the manager 310 allows any provider 308 to access the same set of terminal or media control objects, and use them with any telephony hardware.

Exemplary Methods

In this section of the detailed description, exemplary methods according to embodiments of the invention are presented. This description is provided in reference to FIGs. 4(a) through 4(b). These exemplary methods are desirably realized at least in part as one or more programs running on a computer -- that is, as a program executed from a computer-readable medium such as a memory by a processor of a computer. The programs are desirably storable on a computer-readable medium such as a floppy disk or a CD-ROM, for distribution and installation and execution on another (suitably equipped) computer.

Thus, in one embodiment, a computer program is executed by a processor of a computer from a medium therefrom, where the program may include address objects, call objects, terminal objects, and call-hub objects, as described in the previous section of the detailed description. Each of these objects may in one embodiment also correspond to a specific means for performing the functionality of the object. In another embodiment, the computer program also includes a terminal manager, which detects a plurality of

multimedia devices and instantiates a terminal object for each multimedia device detected, as has also been described in the previous section of the detailed description.

Referring now to FIG. 4(a), a flowchart of a method for placing an outgoing computer telephony call, according to an embodiment of the invention, is shown. In 400, a TAPI object is instantiated by an application program so that the program is able to use the functionality provided by the TAPI. In 402, the TAPI object is initialized. For example, a terminal manager is run to instantiate terminal objects for physical and virtual multimedia devices, as has been described in the previous section of the detailed description.

In 404, the TAPI object is queried for an enumeration of the address objects available from the TAPI object. Each address object has certain telephony capabilities -- for example, one may relate to an ISDN line, another to a PSTN line, etc. Thus, in 406, each address object is queried to learn its telephony capabilities. The desired address object or objects are then selected, depending on the type of call desired (e.g., a regular voice call may go over a PSTN line, a video call may go over one or more ISDN lines, etc.).

In 408, a call object is instantiated from a desired address object or objects. The call object thus relates to the computer performing the method of FIG. 4(a) as being the caller for a specific computer telephony call utilizing the desired address object or objects. In 410, the desired address object or objects are queried for an enumeration of the terminal objects available from the address object or objects. For example, an address object relating to a PSTN line over which voice calls are placed may have a terminal object relating to a microphone

and a terminal object relating to a sound card connected to a speaker. Depending on the type of call desired, then, in 412 at least one desired terminal object enumerated in 410 is selected. Finally, in 414, the outgoing computer telephony call is connected (i.e., placed) over the desired address object or objects utilizing the desired terminal object or objects.

Thus, placing a computer telephony call according to the embodiment of the invention of FIG. 4(a) involves determining the address objects that are available such that a call may be placed over them, and selecting a desired address object or objects. A call object is created for the specific call to be placed. The terminal objects that are available for the utilized address objects are then determined, and the desired terminal objects are selected. The call is then placed, such that the address objects represent the communication media over which the call is placed, and the terminal objects represent the multimedia devices that act as end points for the media stream communicated over the communication media.

Referring next to FIG. 4(b), a flowchart of a method for receiving an incoming computer telephony call, according to an embodiment of the invention, is shown. In 450, a TAPI object is instantiated by an application program so that the program is able to use the functionality provided by the TAPI. In 452, the TAPI object is initialized. For example, a terminal manager is run to instantiate terminal objects for physical and virtual multimedia devices, as has been described in the previous section of the detailed description.

In 454, the TAPI object is queried for an enumeration of the address objects available from the TAPI object. Each address object has certain

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telephony capabilities -- for example, one may relate to an ISDN line, another to a PSTN line, etc. Thus, in 456, each address object is queried to learn its telephony capabilities. The desired address object or objects are then selected, depending on the type of call that is desired to be listened for (e.g., a regular
5 voice call may be received over a PSTN line, a video call may be received over one or more ISDN lines, etc.).

In 458, an event callback is instantiated and registered on the TAPI object. The event callback is a request by the application program performing the method of FIG. 4(b) to have the TAPI object notify the application program
10 when the desired event occurs -- in this case, when an incoming call is received.

In 460, the desired address object or objects are also registered with the TAPI object. These are the address object or objects over which an incoming computer telephony call is to be listen for by the TAPI object, such that upon occurrence of such an event, the application program performing the method of FIG. 4(b) is
15 notified. Thus, in 462, a notification of an incoming computer telephony call from the TAPI object is received on the event callback. After receiving notification, the available terminals are enumerated 464 and the desired terminals are selected 466. In 468, the incoming computer telephony call is connected (i.e., received) over the desired address object or objects.

20 As has been described, receiving a computer telephony call according to the embodiment of the invention of FIG. 4(b) involves determining the address objects that are available such that a call may be received over them, and selecting a desired address object or objects. An event callback is created and registered, so that notification is received when a call arrives over the desired

Variable	Mean	SD	Min	Max
Age	34.5	12.5	18	65
Gender	Male	Female		
Marital Status	Married	Single		
Education	High School	College		
Occupation	Manager	Worker		
Income	\$30,000	\$40,000		
Health Status	Good	Fair		
Stress Level	Low	High		
Life Satisfaction	High	Low		
Work-Life Balance	Good	Poor		
Family Support	Strong	Weak		
Community Involvement	Active	Passive		
Religious Beliefs	Religious	Secular		
Political Views	Conservative	Liberal		
Environmental Concerns	High	Low		
Technology Use	High	Low		
Travel Frequency	Often	Rarely		
Exercise Habits	Regular	Irregular		
Dietary Preferences	Vegetarian	Non-Vegetarian		
Substance Use	None	Occasional		
Artistic Interests	High	Low		
Music Preferences	Classical	Pop		
Reading Habits	Frequent	Infrequent		
Gardening Interests	High	Low		
Volunteering	Often	Rarely		
Charitable Giving	High	Low		
Philanthropy	Active	Passive		
Environmental Activism	High	Low		
Political Participation	Active	Passive		
Community Engagement	High	Low		
Neighborhood Safety	High	Low		
Local Government	Effective	Ineffective		
Public Services	Good	Poor		
Infrastructure	Strong	Weak		
Urban Planning	Good	Poor		
Transportation	Convenient	Inconvenient		
Parking Availability	High	Low		
Public Transit	Used	Not Used		
Walking/Biking	Often	Rarely		
Car Ownership	Yes	No		
Vehicle Type	Sedan	SUV		
Vehicle Age	5 years	10 years		
Vehicle Mileage	50,000	100,000		
Vehicle Maintenance	Regular	Irregular		
Vehicle Insurance	Yes	No		
Vehicle Registration	Yes	No		
Vehicle Safety Features	Yes	No		
Vehicle Performance	Good	Poor		
Vehicle Reliability	High	Low		
Vehicle Fuel Efficiency	High	Low		
Vehicle Color	Black	White		
Vehicle Accessories	Yes	No		
Vehicle Modifications	Yes	No		
Vehicle History	Accident-free	Accident-prone		
Vehicle Resale Value	High	Low		
Vehicle Leasing	Yes	No		
Vehicle Financing	Yes	No		
Vehicle Insurance Cost	High	Low		
Vehicle Registration Cost	High	Low		
Vehicle Maintenance Cost	High	Low		
Vehicle Fuel Cost	High	Low		
Vehicle Depreciation	High	Low		
Vehicle Theft Risk	High	Low		
Vehicle Damage Risk	High	Low		
Vehicle Safety Rating	High	Low		
Vehicle Recall Status	None	Active		
Vehicle Recall Action	Completed	Pending		
Vehicle Recall Cost	High	Low		
Vehicle Recall Impact	High	Low		
Vehicle Recall Frequency	High	Low		
Vehicle Recall Severity	High	Low		
Vehicle Recall Resolution	Fast	Slow		
Vehicle Recall Satisfaction	High	Low		
Vehicle Recall Transparency	High	Low		
Vehicle Recall Accountability	High	Low		
Vehicle Recall Communication	Effective	Ineffective		
Vehicle Recall Education	High	Low		
Vehicle Recall Awareness	High	Low		
Vehicle Recall Trust	High	Low		
Vehicle Recall Loyalty	High	Low		
Vehicle Recall Retention	High	Low		
Vehicle Recall Engagement	High	Low		
Vehicle Recall Participation	High	Low		
Vehicle Recall Contribution	High	Low		
Vehicle Recall Impact	High	Low		
Vehicle Recall Effectiveness	High	Low		
Vehicle Recall Success	High	Low		
Vehicle Recall Satisfaction	High	Low		
Vehicle Recall Transparency	High	Low		
Vehicle Recall Accountability	High	Low		
Vehicle Recall Communication	Effective	Ineffective		
Vehicle Recall Education	High	Low		
Vehicle Recall Awareness	High	Low		
Vehicle Recall Trust	High	Low		
Vehicle Recall Loyalty	High	Low		
Vehicle Recall Retention	High	Low		
Vehicle Recall Engagement	High	Low		
Vehicle Recall Participation	High	Low		
Vehicle Recall Contribution	High	Low		
Vehicle Recall Impact	High	Low		
Vehicle				

Pluggable Terminals

In the past, integrating many proprietary media processing devices into a TAPI system was messy. Consider the plight of a user trying to get TAPI to work with many different types of proprietary media processing devices—each with a different interface and method of operation requiring special treatment. Also, if a user wanted to add a new media processing device defined by a third party, then the user had to either revise TAPI APIs or program a private extension into a Media Stream Provider (MSP) component.

Now in TAPI 3.1, users have greater flexibility and ease with pluggable terminals. New media processing devices defined by third parties, such as sound cards, cameras, microphones, speakers, and virtual devices, are plugged into TAPI as pluggable terminals ready to send or receive multimedia communications. Pluggable terminals hide the detailed information about how the media processing device works and provide a uniform interface to TAPI. Thus, TAPI uses each pluggable terminal for multimedia communications in the same way; no special treatment is necessary. TAPI no longer needs detailed information about how each device works and users no longer need to program private extensions into the MSP component. Pluggable terminals allow TAPI to process media generically, so users can easily plug in whatever new media processing they want to do. Furthermore, once a pluggable terminal is created and plugged in, it becomes available to all users.

One aspect of the present invention is directed to systems, methods, and data structures for pluggable terminals. Pluggable terminals are part of client and server TAPI communications systems. One software system comprises a

These and other features, aspects, and advantages of the present invention will become better understood with reference to the following description and appended claims.

Figure 5 shows an embodiment of the TAPI architecture similar to Figure 3, except for the addition of a pluggable terminal 512, which is shown in relation to the rest of the architecture. A pluggable terminal 512 is a type of terminal object that allows third parties to provide their own media processing devices and implement control methods for those devices. A terminal object represents a source or sink for media at a termination or origination point of a connection associated with a media stream. The terminal object represents a media processing device which may be a hardware device, such as a telephone or microphone; a software device, such as Internet Protocol (IP) telephony software; a virtual device, such as a window on a computer screen; or any other device capable of receiving input or creating output.

In one embodiment, the pluggable terminal 512 is plugged in and made available to a TAPI application component 500 to process media during a communications session. The TAPI application component 500 is an application program that uses the computer telephony services provided by a TAPI component 502. Some example TAPI applications are web phones, electronic banking, videoconferencing, electronic commerce, television set top boxes, web gaming, handheld computing, mobile phones, and the like. The communications session is an exchange of information over a connection among terminals, such as an IP telephony call. The communications session includes multiple simultaneous communications, such as playing music while saving it to a file.

In one embodiment, when the TAPI application component 500 initializes TAPI 502, a terminal manager component 510 creates a terminal object based on a pluggable terminal type associated with the pluggable terminal 512 and registers the pluggable terminal 512. The terminal manager component 510 discovers all available terminals, including the pluggable terminal 512, and gives a list of them to the TAPI application component 500 so that one or more may be selected for a communications session.

In one embodiment, once the pluggable terminal 512 is selected by the TAPI application component 500, the pluggable terminal 512 processes media during the communications session. A Media Stream Provider (MSP) component 508 controls the media processing and coordinates the media processing with a Telephony Service Provider (TSP) component 506. The TSP component 506 performs call control and controls communications devices. The TSP component 506 controls communications devices, such as modems, the H323 protocol for IP telephony, specialized communications protocols, and other hardware and software communications devices. A TAPI server component 504 tracks telephony resources.

Figure 6 shows a system embodying the present invention. In one embodiment, the system comprises a TAPI application component 600 for conducting communications sessions and one or more pluggable terminals 602 for processing media during communications sessions. In one embodiment, the system also comprises one or more TSP components 606 and one or more MSP components 604. There is a one-to-one correspondence between TSP components 606 and MSP components 604. A MSP component 604 controls

media processing in cooperation with a TSP component 606 which performs call control. In one embodiment, the system includes a terminal manager component 608. The terminal manager component 608 provides the TAPI application component 600 with a list of available terminals, including the pluggable terminals 602, through an MSP component 604. The TAPI application 600 selects a pluggable terminal 602 for a communications session and the pluggable terminal 602 processes media to or from a media processing device.

One system embodiment, such as the system in Figure 6, comprises software components implemented as Common Object Model (COM) components, but the present invention could also be implemented as Common Object Request Broker Architecture (CORBA) components, Remote Method Invocation (RMI) between Java objects, or some other architecture enabling pieces of programs, called objects, to communicate with one another regardless of what programming language they were written in.

Figure 7 shows two system embodiments of the present invention. In one embodiment, a TAPI communications system 700 comprises one or more pluggable terminals 702 operating on a processor 704 coupled to a storage device 706, where a selected pluggable terminal 702 processes media during a communications session. Some examples of TAPI communications systems 700 are portable devices, wearable computers, tablets, handheld devices, pocket-sized personal computers and the like. In another embodiment, a TAPI application component 712, which is located on a different processor from the pluggable terminal 702, selects a pluggable terminal 702 for a communications session. Again, the processor 714 is coupled to a storage device 716. After

selecting the pluggable terminal 702, the TAPI application component 712 conducts a communications session using the pluggable terminal 702 for media processing. One example of a TAPI communications system 710 is an internet subscription service delivering a service to a subscriber.

5 Figure 8 shows another system embodiment of the present invention. In this embodiment, a TAPI communications system 800 comprises a TAPI application component 802 and one or more pluggable terminals 804 all operating on the same processor 806, which is coupled to a storage device 808. In this embodiment, the TAPI application component 802 selects a pluggable
10 terminal 804 that is located on the same processor as the TAPI application component 802 itself. One example of system 800 is playing music and recording it on the same system 800.

 Figure 9 shows one method embodiment of the present invention. A method of plugging in a pluggable terminal 900 comprises wrapping a media
15 processing device control method to create a pluggable terminal type 902 and making the pluggable terminal type available to a TAPI application component 904. Wrapping means mapping the data structures and methods of the media processing device control method onto the pluggable terminal type in a way that allows the media processing device control method to operate as a pluggable
20 terminal. This enables interfacing software components, such as a TAPI application component, to handle each pluggable terminal object using the same methods.

 In one embodiment, making the pluggable terminal type available to the TAPI application component 1000 comprises the following acts shown in Figure

10: creating a terminal object from the pluggable terminal type upon
initialization of a TAPI system 1002; registering the pluggable terminal 1004;
discovering all available terminals, including the pluggable terminal 1006; and
sending a list of available terminals, including the pluggable terminal, to the
5 TAPI application component 1007.

In one embodiment, wrapping the media processing device control
method 1100 comprises the following acts shown in Figure 11: deriving the
pluggable terminal type from a terminal base class 1102; providing a first
interface for plugging into a TAPI system 1104; and providing a second
10 interface including at least one media processing method for the TAPI
application component 1106.

Figure 12 shows a list of some media types 1202 processed by the media
processing methods. In one method embodiment, providing a second interface,
including at least one media processing method for the TAPI application
15 component 1106, comprises: providing at least one media processing method
for processing media selected from the list of media types 1200. The media
types include, but are not limited to, the following groups:

1. Audio, video, text, and graphics;
- 20 2. Modem transmissions, facsimile transmissions, and telephony
transmissions;
3. Videoconferencing transmissions, co-browsing transmissions,
application sharing transmissions, document sharing transmissions,
and collaborative computing transmissions;
4. Chat transmissions, visual chat transmissions, IP telephony
25 transmissions, and instant messaging transmissions;
5. PSTN calls, tone transmissions, speech transmissions, IP interactive
voice response system transmissions, IP unified message system
transmissions, and caller identification transmissions;
6. Music, movies, still pictures, and photographs;

7. Radio transmissions, television transmissions, and cable transmissions;
8. Portable device transmissions, wearable computer transmissions, tablet transmissions, handheld device transmissions, and pocket-sized personal computer transmissions; and
9. Digital phone calls and cellular phone calls.

The invention is not limited to a method of processing media from any one group.

Figure 13 shows a method embodiment of the present invention. A method of plugging in a pluggable terminal 1300 comprises: creating the media processing device control method 1302; wrapping a media processing device control method to create a pluggable terminal type 1304; and making the pluggable terminal type available to a TAPI application component 1306. One

way to create a media processing device control method is to implement a Microsoft® DirectShow® filter as a driver for the device. In an example embodiment, a hardware vendor creates methods for controlling a media processing device including media streaming methods matching the capabilities of at least one MSP component using Microsoft® DirectShow® filters.

Microsoft® DirectShow® services provide playback multimedia streams from local files or Internet servers and capture of multimedia streams from devices. At the heart of the Microsoft® DirectShow® services is a modular system of pluggable components called filters, arranged in a configuration called a filter graph. A component called the filter graph manager oversees the connection of these filters and controls the stream's data flow. The invention is not limited to creating a media processing device control method using Microsoft® DirectShow® filters and other methods may be used.



Figure 14 shows a method embodiment of the present invention. A method of using a pluggable terminal 1400 comprises: plugging in the pluggable terminal 1402; selecting a pluggable terminal from a list of available terminals for a communications session 1404; and processing media during the communications session by performing at least one method of media processing in the pluggable terminal 1406. In one embodiment, plugging in the pluggable terminal 1402 comprises making the pluggable terminal available to a TAPI application component.

In one method embodiment of the present invention shown in Figure 15, selecting the pluggable terminal from the list of available terminals for a communications session 1500 comprises: requesting a list of available terminals 1502; discovering all available terminals, including the pluggable terminal 1504; listing all available terminals 1506; selecting the pluggable terminal from the list of available terminals 1508; and creating a terminal object from a pluggable terminal type associated with the selected pluggable terminal 1510. In another embodiment, the method 1500 also includes controlling media processing 1512 and coordinating media processing with call control 1514.

Figure 16 shows a data structure embodiment of the present invention. A computer-readable medium has a data structure for registering a pluggable terminal 1600. In one embodiment, the data structure comprises a terminal class name 1602, a unique identifier 1604 for the pluggable terminal, a set of media flow directions 1606, and a set of media types 1608. The terminal class name 1602 identifies a terminal class that the pluggable terminal belongs to. For example, a terminal manager component implements a pluggable terminal as a

1616. In a further embodiment, the data structure 1600 also includes a method for firing events to a terminal manager component 1618. However, the method 1618 is not limited to an event mechanism and may also be a method of callbacks or any other method for signaling events among components.

5 Figure 17 shows a data structure embodiment of the present invention. A pluggable terminal type data structure 1700 comprises a media processing device control method 1702 and a wrapper around the media processing device control method 1704. In one embodiment, the wrapper comprises: a first interface for plugging in the pluggable terminal 1706; a second interface 1708 including at
10 least one media processing method for a TAPI application component 1710; and at least one method for controlling the media processing device 1712.

 In one embodiment shown in Figure 18, the pluggable terminal type data structure 1700 has one or more methods for controlling a media processing device 1800, where the device supports a media type selected from one of the
15 following groups 1802:

1. Audio, video, text, and graphics;
2. Modern transmissions, facsimile transmissions, and telephony transmissions;
3. Videoconferencing transmissions, co-browsing transmissions, application sharing transmissions, document sharing transmissions, and collaborative computing transmissions;
4. Chat transmissions, visual chat transmissions, IP telephony transmissions, and instant messaging transmissions;
5. PSTN calls, tone transmissions, speech transmissions, IP interactive voice response system transmissions, IP unified message system transmissions, and caller identification transmissions;
6. Music, movies, still pictures, and photographs;
7. Radio transmissions, television transmissions, and cable transmissions;
8. Portable device transmissions, wearable computer transmissions, tablet transmissions, handheld device transmissions, and pocket-sized personal computer transmissions; and

9. Digital phone calls and cellular phone calls.

The invention is not limited to selecting a media type from any one group.

Figure 19 shows a terminal base class data structure 1900 comprising a
5 first interface for plugging in a pluggable terminal 1902 and a second interface
for a TAPI application component 1904. In one embodiment, a pluggable
terminal type is derived from a terminal base class.

The following example shows how to create a pluggable terminal for a
new audio file format. In an example embodiment, a hardware vendor figures
10 out how the audio file format fits into DirectShow®, creates filters using
DirectShow®, wraps the audio file format processing methods as a pluggable
terminal, and then plugs it into the TAPI system.

The following example shows how to leverage existing media processing
code. In an example embodiment, a TAPI application developer, who is
15 transitioning applications from TAPI version 2 to TAPI version 3 and, therefore,
has existing code manipulating media streams directly, wraps that code in a
pluggable terminal and then plugs it into the TAPI system.

The following example shows how pluggable terminals are created
automatically by a TAPI system. In an example embodiment, a terminal
20 manager component uses DirectShow® to find all multimedia devices present on
a computer and then creates pluggable terminals corresponding to each
multimedia device. For example, a wave device is wrapped as a pluggable
terminal.

In an example embodiment, a TAPI application component selects
25 specific pluggable terminals to use on a computer telephony call. In another

What is claimed is:

- 1 1. A method of plugging in a pluggable terminal comprising:
2 wrapping a media processing device control method to create a pluggable
3 terminal type; and
4 making the pluggable terminal type available to a TAPI application
5 component.

- 1 2. The method of claim 1 wherein making the pluggable terminal type
2 available to a TAPI application component comprises:
3 creating a terminal object from the pluggable terminal type upon
4 initialization of a TAPI system;
5 registering the pluggable terminal;
6 discovering all available terminals, including the pluggable terminal; and
7 sending a list of available terminals, including the pluggable terminal, to
8 the TAPI application component.

- 1 3. The method of claim 1 wherein wrapping the media processing device
2 control method comprises:
3 deriving the pluggable terminal type from a terminal base class;
4 providing a first interface for plugging into a TAPI system; and
5 providing a second interface including at least one media processing
6 method for the TAPI application component.

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1 4. The method of claim 3 wherein providing the second interface including
2 at least one media processing method comprises providing at least one media
3 processing method for processing media selected from the group consisting of
4 audio, video, text, and graphics.

1 5. The method of claim 3 wherein providing the second interface including
2 at least one media processing method comprises providing at least one media
3 processing method for processing media selected from the group consisting of
4 modem transmissions, facsimile transmissions, and telephony transmissions.

1 6. The method of claim 3 wherein providing the second interface including
2 at least one media processing method comprises providing at least one media
3 processing method for processing media selected from the group consisting of
4 videoconferencing transmissions, co-browsing transmissions, application sharing
5 transmissions, document sharing transmissions, and collaborative computing
6 transmissions.

1 7. The method of claim 3 wherein providing the second interface including
2 at least one media processing method comprises providing at least one media
3 processing method for processing media selected from the group consisting of
4 chat transmissions, visual chat transmissions, Internet Protocol (IP) Telephony
5 transmissions, and instant messaging transmissions.

6 selecting the pluggable terminal from the list of available terminals; and
7 creating a terminal object from a pluggable terminal type associated with
8 the selected pluggable terminal.

1 17. The method of claim 14 further comprising:
2 controlling media processing; and
3 coordinating media processing with call control.

1 18. A computer-readable medium having a data structure for registering a
2 pluggable terminal, the data structure comprising:
3 a terminal class name identifying a terminal class that the pluggable
4 terminal belongs to;
5 a unique identifier for the pluggable terminal;
6 a set of media flow directions supported by the pluggable terminal; and
7 a set of media types supported by the pluggable terminal.

1 19. The data structure of claim 18 further comprising:
2 a name for the pluggable terminal;
3 a company name identifying a company that made the pluggable
4 terminal; and
5 a version for the pluggable terminal.

1 20. The data structure of claim 18 wherein a media flow direction in the set
2 of media flow directions is selected from the group consisting of flowing to the
3 pluggable terminal and flowing from the pluggable terminal.

1 21. The data structure of claim 18 wherein a media type in the set of media
2 types is selected from the group consisting of audio, video, text, and graphics.

1 22. The data structure of claim 18 wherein a media type in the set of media
2 types is selected from the group consisting of modem transmissions, facsimile
3 transmissions, and telephony transmissions.

1 23. The data structure of claim 18 wherein a media type in the set of media
2 types is selected from the group consisting of videoconferencing transmissions,
3 co-browsing transmissions, application sharing transmissions, document sharing
4 transmissions, and collaborative computing transmissions.

1 24. The data structure of claim 18 wherein a media type in the set of media
2 types is selected from the group consisting of chat transmissions, visual chat
3 transmissions, Internet Protocol (IP) Telephony transmissions, and instant
4 messaging transmissions.

1 25. The data structure of claim 18 wherein a media type in the set of media
2 types is selected from the group consisting of Public Switched Telephone
3 Network (PSTN) calls, tone transmissions, speech transmissions, IP interactive

1 31. The data structure of claim 18 further comprising a method for firing
2 events to a terminal manager component.

1 32. A computer-readable medium having computer-executable components
2 comprising:

3 a TAPI application component for conducting at least one
4 communications session; and
5 at least one pluggable terminal for processing media during the
6 communications session.

1 33. The computer-readable medium of claim 33 further comprising:
2 at least one Telephony Service Provider (TSP) component for call control
3 and for controlling communications devices; and
4 at least one Media Stream Provider (MSP) component for controlling
5 media processing and for coordinating media processing with the
6 at least one TSP component.

1 34. The computer-readable medium of claim 34 further comprising a
2 terminal manager component for providing the TAPI application component
3 with a list of available terminals and for implementing terminals.

1 35. A TAPI communications system, comprising:
2 a processor;
3 a storage device coupled to the processor; and

4 at least one pluggable terminal operative on the processor to process
5 media during a communications session.

1 36. The system of claim 36 further comprising a TAPI application
2 component to select the pluggable terminal for a communications session.

1 37. A TAPI communications system, comprising:
2 a processor;
3 a storage device coupled to the processor; and
4 a TAPI application component operative on the processor to select a
5 pluggable terminal for a communications session and to conduct
6 the communications session.

1 38. The system of claim 37 further comprising the pluggable terminal for
2 processing media during the communications session.

3 39. A computer-readable medium having a pluggable terminal type data
4 structure comprising:
5 a media processing device control method; and
6 a wrapper around the media processing device control method.

1 40. The data structure of claim 39 wherein the wrapper comprises:
2 a first interface for plugging in the pluggable terminal;

3 controlling a media processing device supporting media selected from the group
4 consisting of chat transmissions, visual chat transmissions, Internet Protocol (IP)
5 Telephony transmissions, and instant messaging transmissions.

1 45. The data structure of claim 40 wherein the at least one method for
2 controlling a media processing device comprises at least one method for
3 controlling a media processing device supporting media selected from the group
4 consisting of Public Switched Telephone Network (PSTN) calls, tone
5 transmissions, speech transmissions, IP interactive voice response system
6 transmissions, IP unified message system transmissions, and caller identification
7 transmissions.

1 46. The data structure of claim 40 wherein the at least one method for
2 controlling a media processing device comprises at least one method for
3 controlling a media processing device supporting media selected from the group
4 consisting of music, movies, still pictures, and photographs.

1 47. The data structure of claim 40 wherein the at least one method for
2 controlling a media processing device comprises at least one method for
3 controlling a media processing device supporting media selected from the group
4 consisting of radio transmissions, television transmissions, and cable
5 transmissions.

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1 48. The data structure of claim 40 wherein the at least one method for
2 controlling a media processing device comprises at least one method for
3 controlling a media processing device supporting media selected from the group
4 consisting of portable device transmissions, wearable computer transmissions,
5 tablet transmissions, handheld device transmissions, and pocket-sized personal
6 computer transmissions.

1 49. The data structure of claim 40 wherein the at least one method for
2 controlling a media processing device comprises at least one method for
3 controlling a media processing device supporting media selected from the group
4 consisting of digital phone calls and cellular phone calls.

1 50. A computer-readable medium having a terminal base class data structure
2 comprising:
3 a first interface for plugging in a pluggable terminal; and
4 a second interface for a TAPI application component.

PLUGGABLE TERMINAL ARCHITECTURE FOR TAPI

Abstract of the Disclosure

Systems, methods, and data structures for pluggable terminals are provided. Pluggable terminals are part of client and server TAPI communications systems. Pluggable terminal allow third parties to provide their own media processing devices and implement control methods for those devices. Methods for plugging in a pluggable terminal and conducting a communications session using the new pluggable terminal are described. A data structure for a pluggable terminal type has a wrapper around a media processing device control method. A data structure for registering a pluggable terminal has a terminal class name, a unique identifier, and a set of media types supported by the pluggable terminal. A data structure for a terminal base class has an interface for plugging in a pluggable terminal and another interface for a TAPI application component.

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8 pursuant to 37 CFR 1.10, and is addressed to the Commissioner for Patents, Box Patent Application,
9 Washington, D.C. 20231.

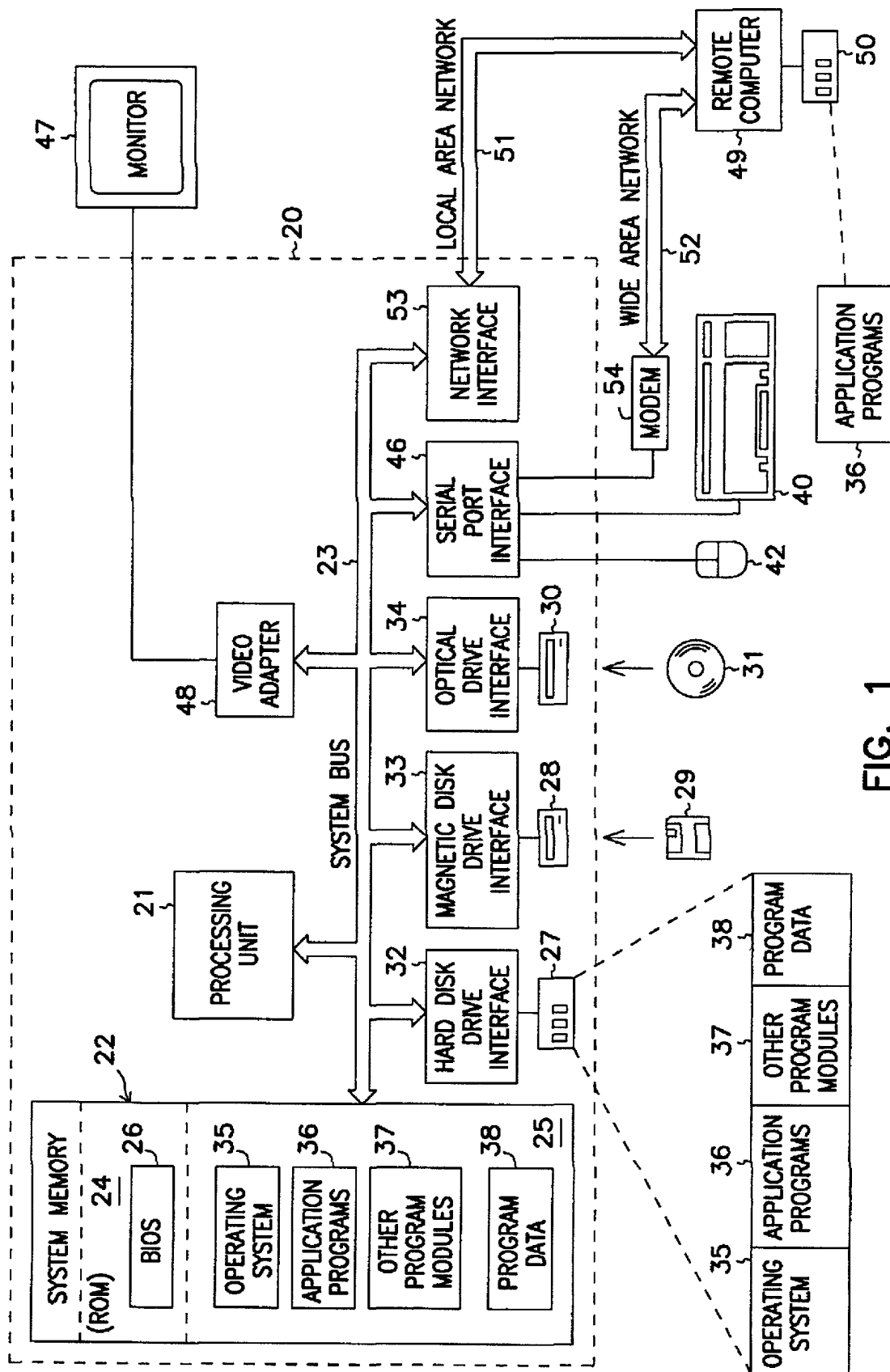


FIG. 1

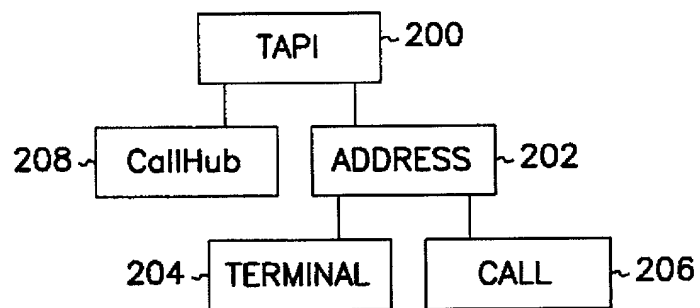


FIG. 2

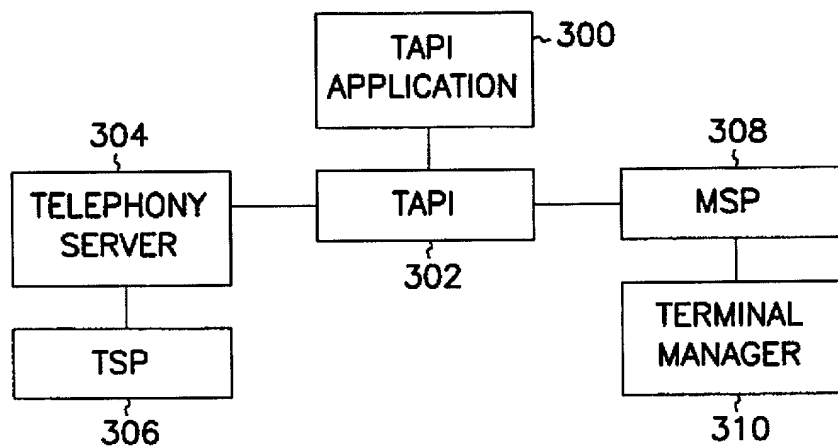


FIG. 3

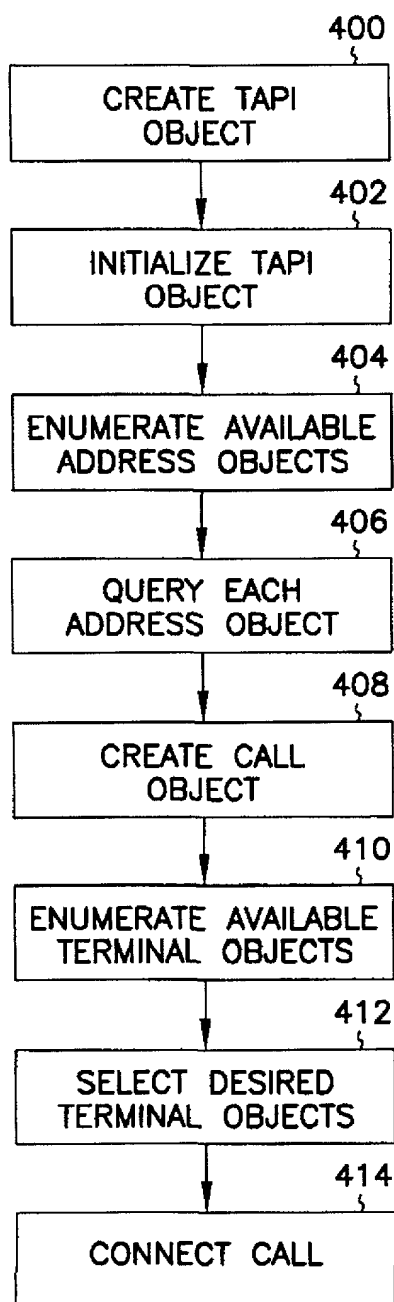


FIG. 4(a)

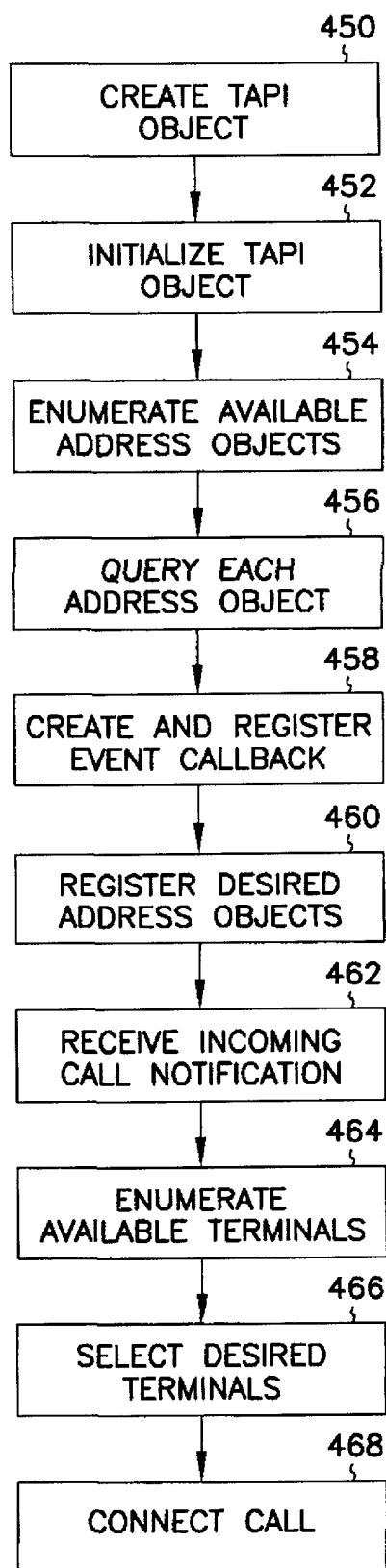


FIG. 4(b)

[illegible]

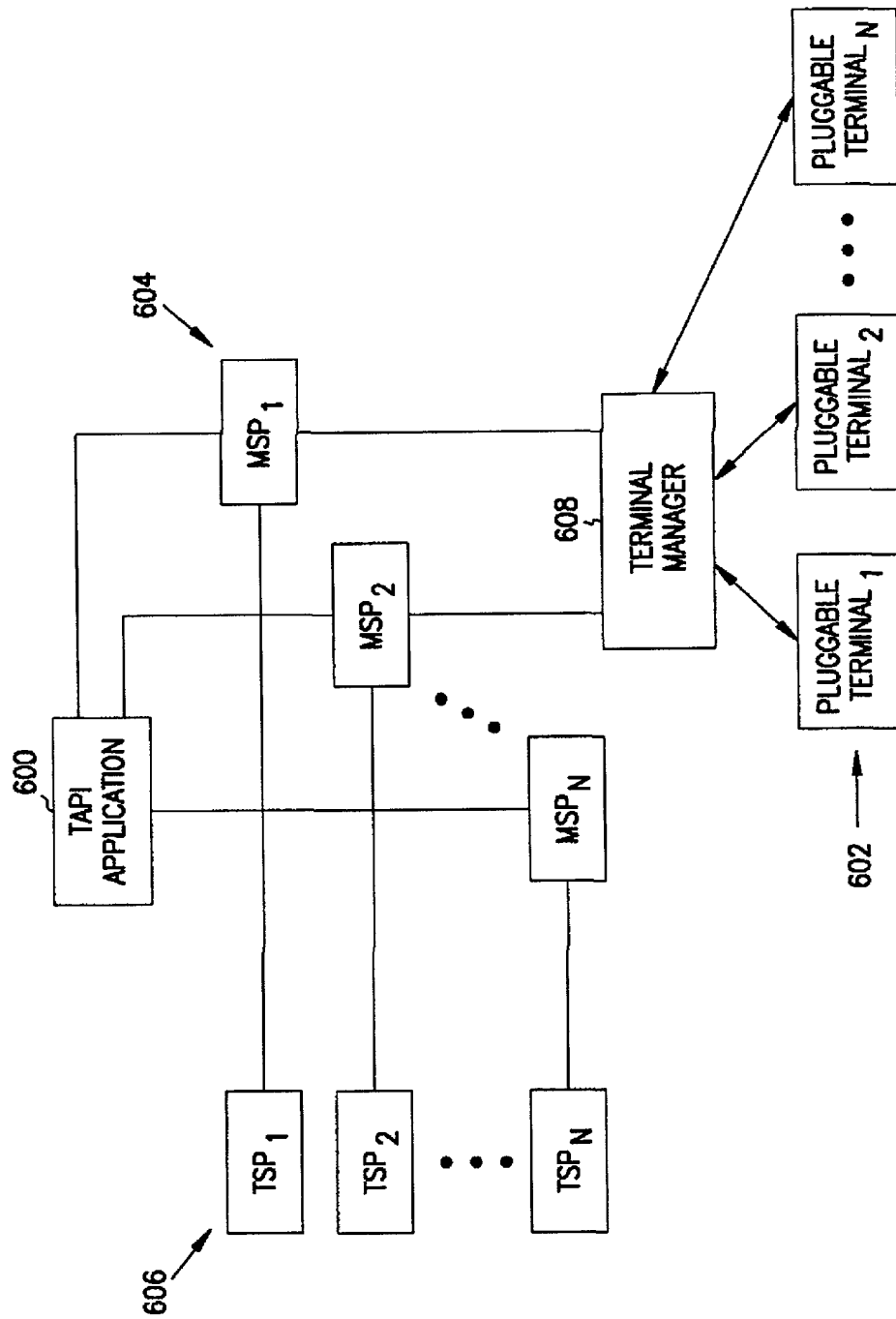


FIG. 6

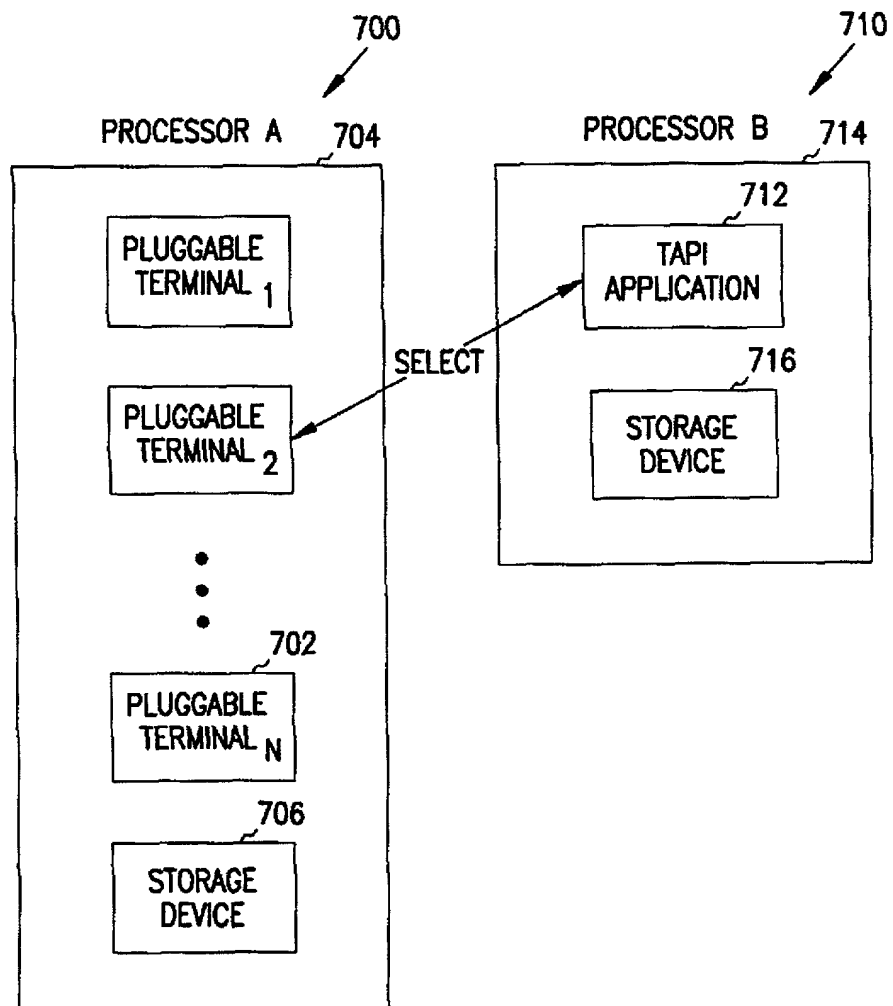


FIG. 7

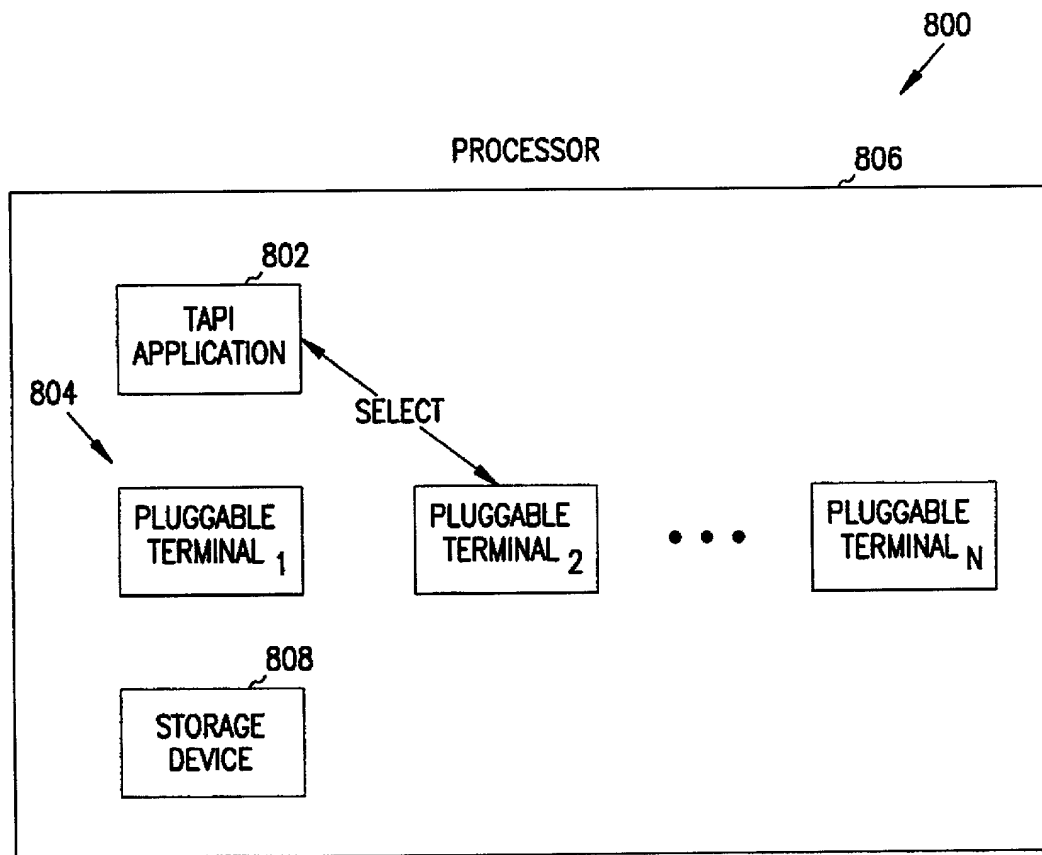


FIG. 8

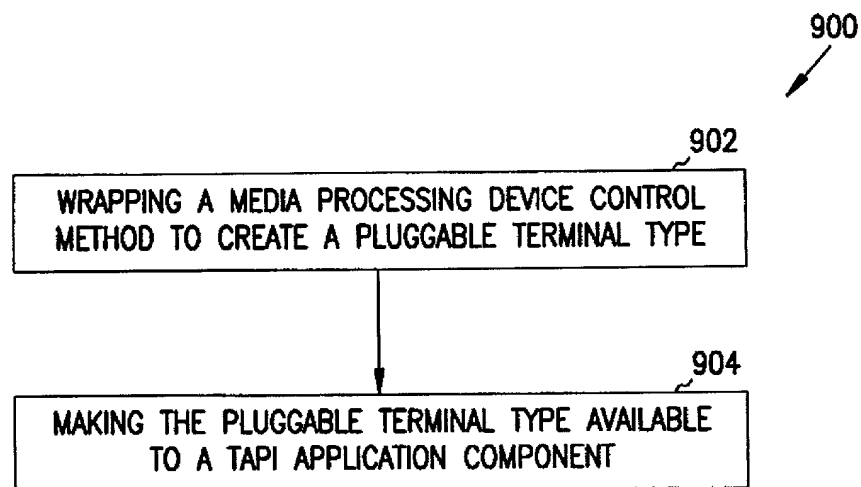


FIG. 9

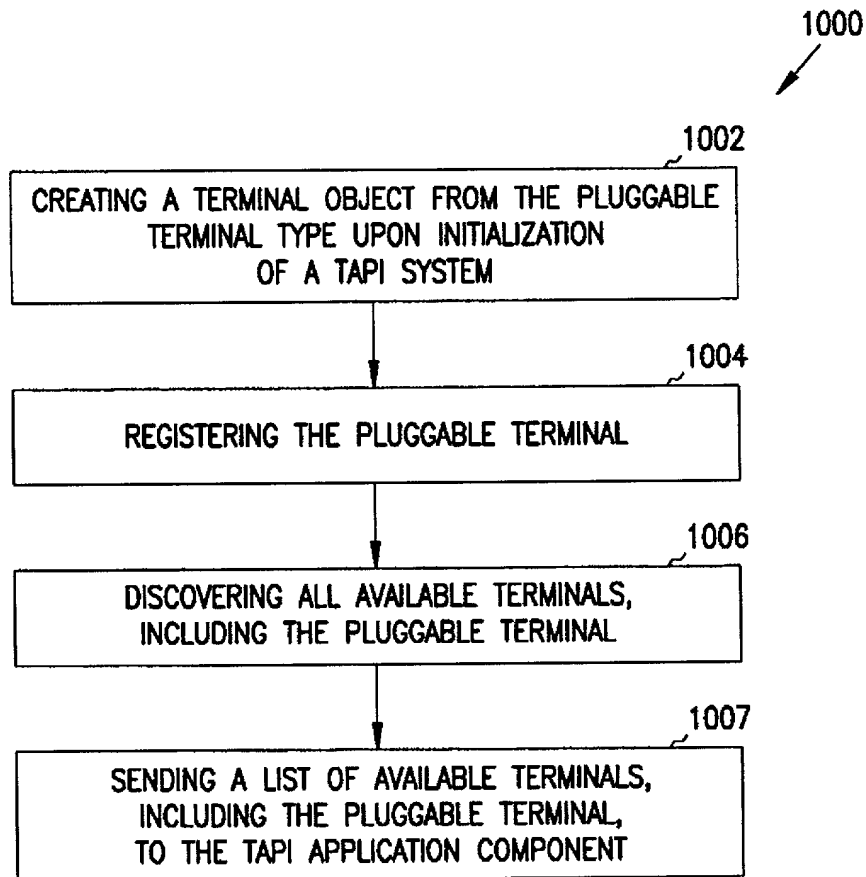


FIG. 10

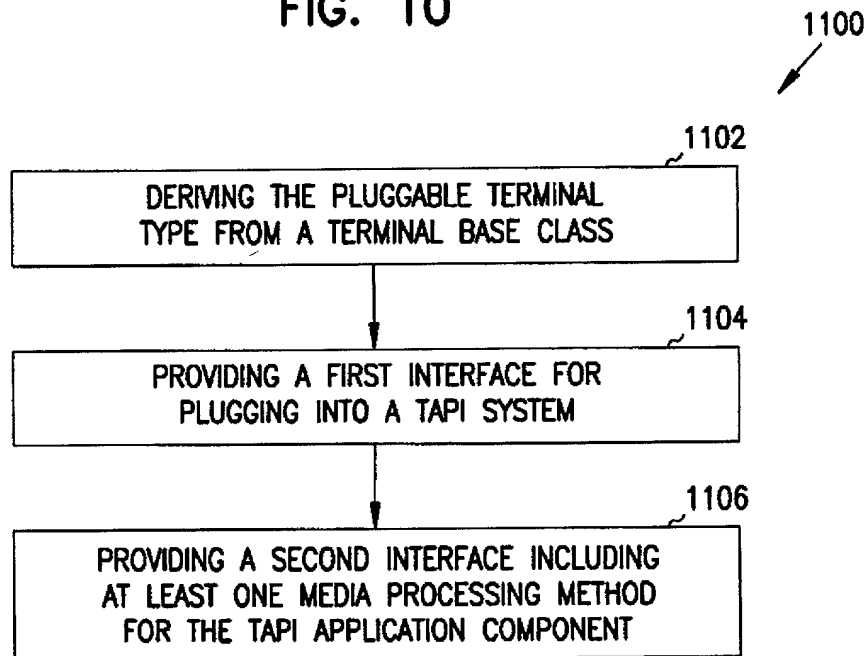


FIG. 11

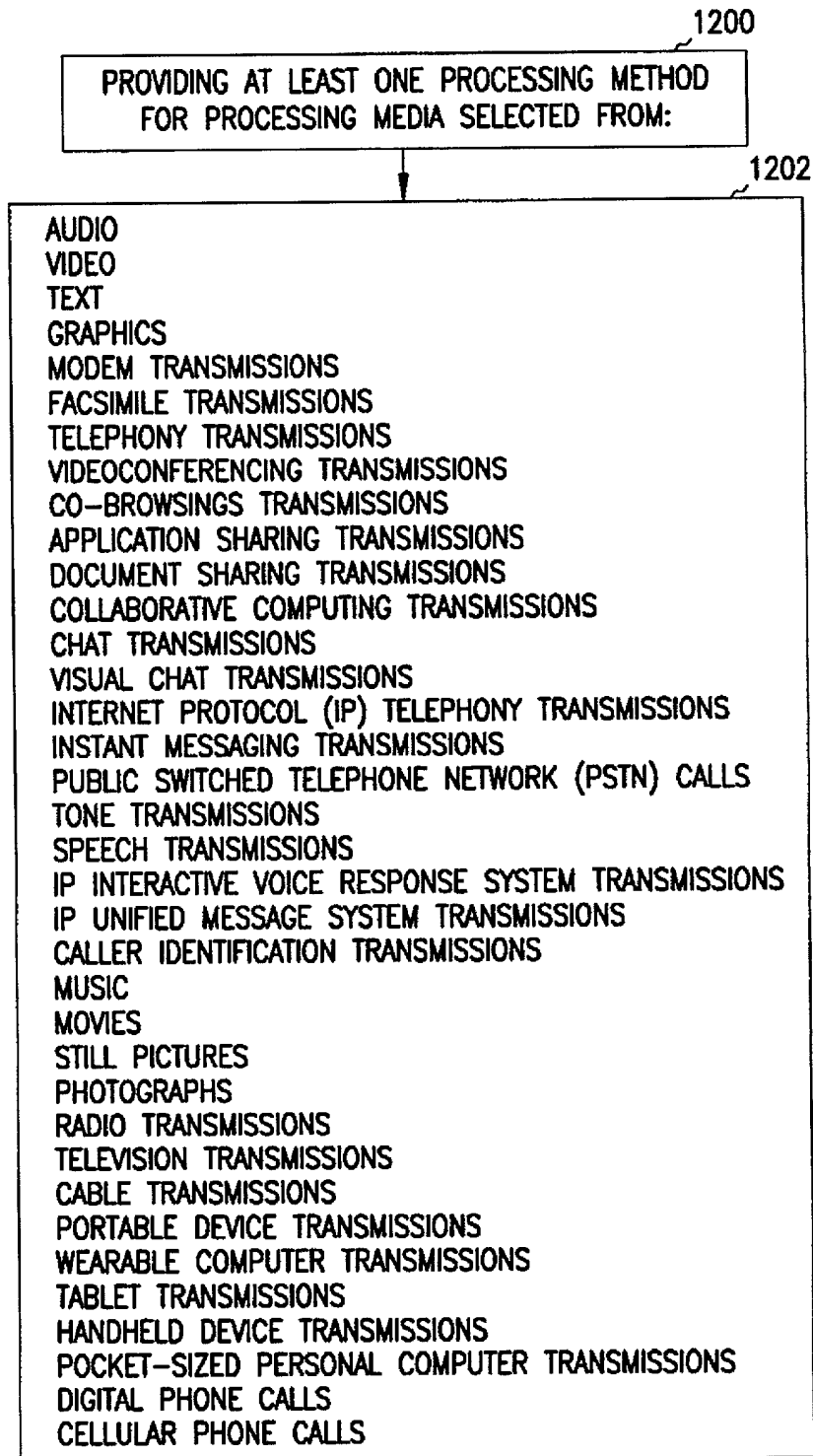


FIG. 12

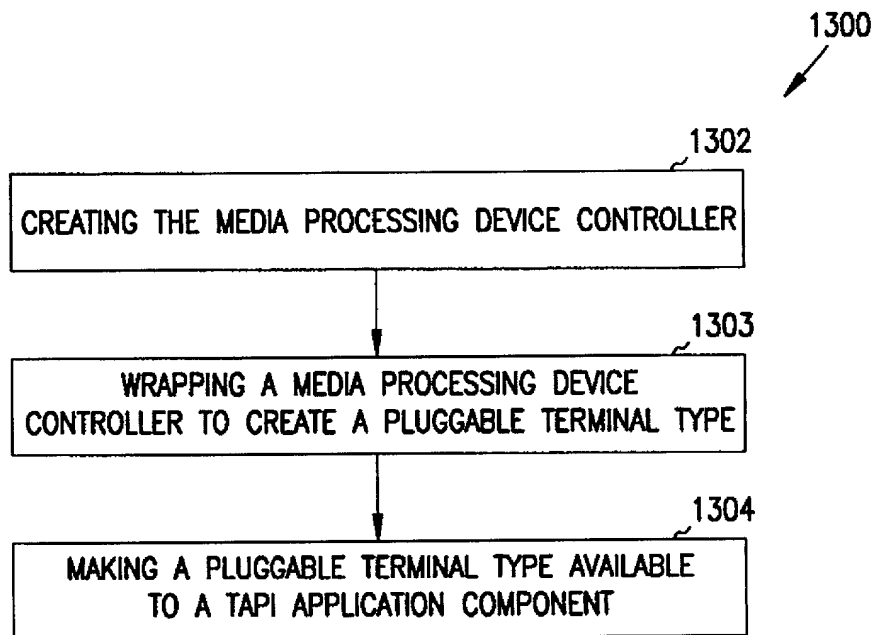


FIG. 13

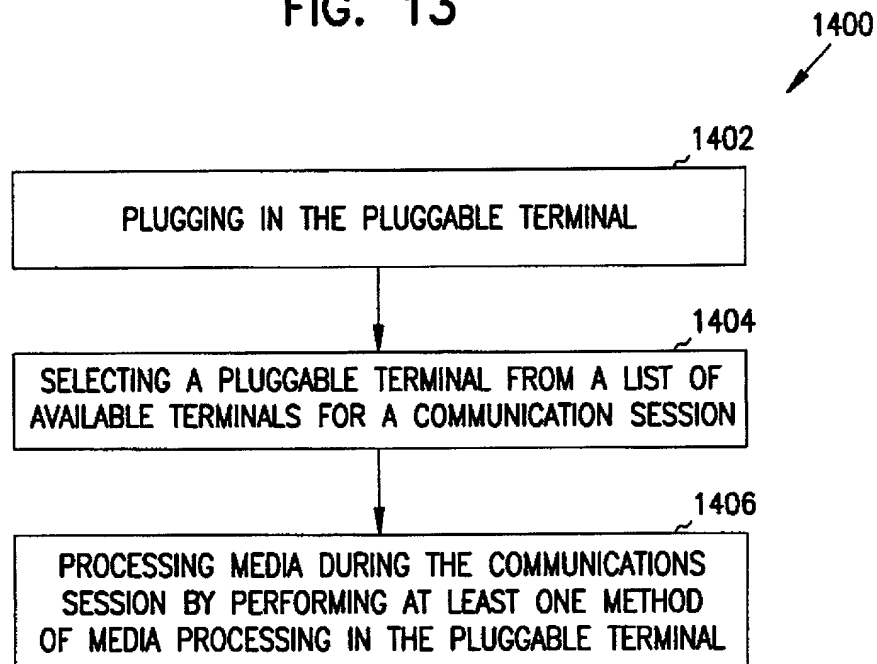


FIG. 14

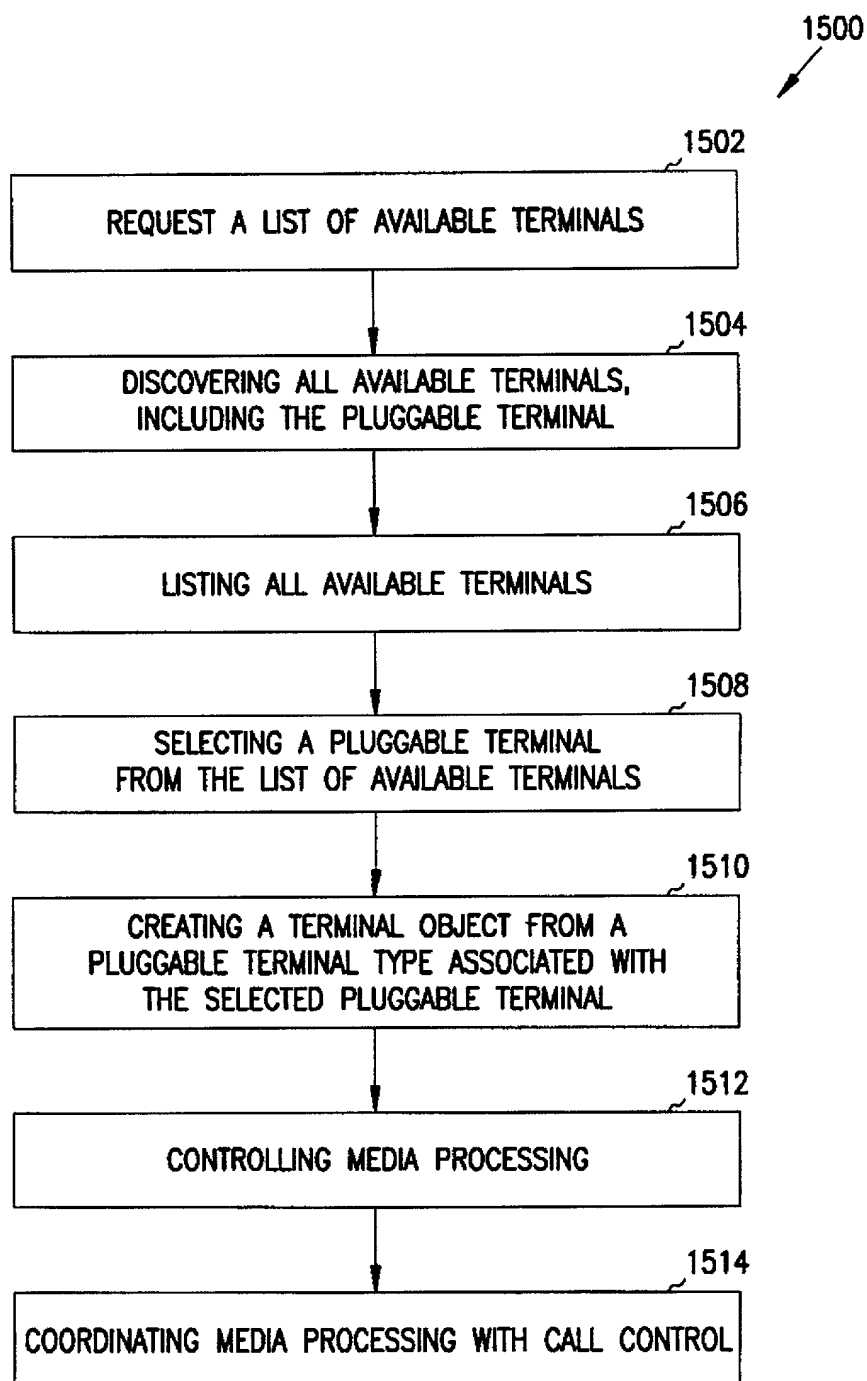


FIG. 15

1600

DATA STRUCTURE FOR REGISTERING A PLUGGABLE TERMINAL

TERMINAL CLASS NAME	1602
UNIQUE IDENTIFIER	1604
SET MEDIA FLOW DIRECTIONS = {FLOWING TO THE PLUGGABLE TERMINAL, FLOWING FROM THE PLUGGABLE TERMINAL}	1606
SET MEDIA TYPES = {AUDIO, VIDEO, TEXT, GRAPHICS, MODEM TRANSMISSIONS, FACSIMILE TRANSMISSIONS, TELEPHONY TRANSMISSIONS, VIDEOCONFERENCING TRANSMISSIONS, CO-BROWSING TRANSMISSIONS, APPLICATION SHARING TRANSMISSIONS, DOCUMENT SHARING TRANSMISSIONS, COLLABORATIVE COMPUTING TRANSMISSIONS, CHAT TRANSMISSIONS VISUAL CHAT TRANSMISSIONS, INTERNET PROTOCOL (IP) TELEPHONY TRANSMISSIONS, INSTANT MESSAGING TRANSMISSIONS, PUBLIC SWITCHED TELEPHONE NETWORK (PSTN) CALLS, TONE TRANSMISSIONS, SPEECH TRANSMISSIONS, IP INTERACTIVE VOICE RESPONSE SYSTEM TRANSMISSIONS, IP UNIFIED MESSAGE SYSTEM TRANSMISSIONS, CALLER IDENTIFICATION TRANSMISSIONS, MUSIC, MOVIES, STILL PICTURES, PHOTOGRAPHS, RADIO TRANSMISSIONS, TELEVISION TRANSMISSIONS, CABLE TRANSMISSIONS, PORTABLE DEVICE TRANSMISSIONS, WEARABLE COMPUTER TRANSMISSIONS, TABLET TRANSMISSIONS, HANDHELD DEVICE TRANSMISSIONS, POCKET-SIZED PERSONAL COMPUTER TRANSMISSIONS, DIGITAL PHONE CALLS, CELLULAR PHONE CALLS}	1608
NAME	1610
COMPANY NAME	1612
VERSION	1614
METHOD FOR REGISTERING ITSELF	1616
METHOD FOR FIRING EVENTS TO A TERMINAL MANAGER COMPONENT	1618

FIG. 16

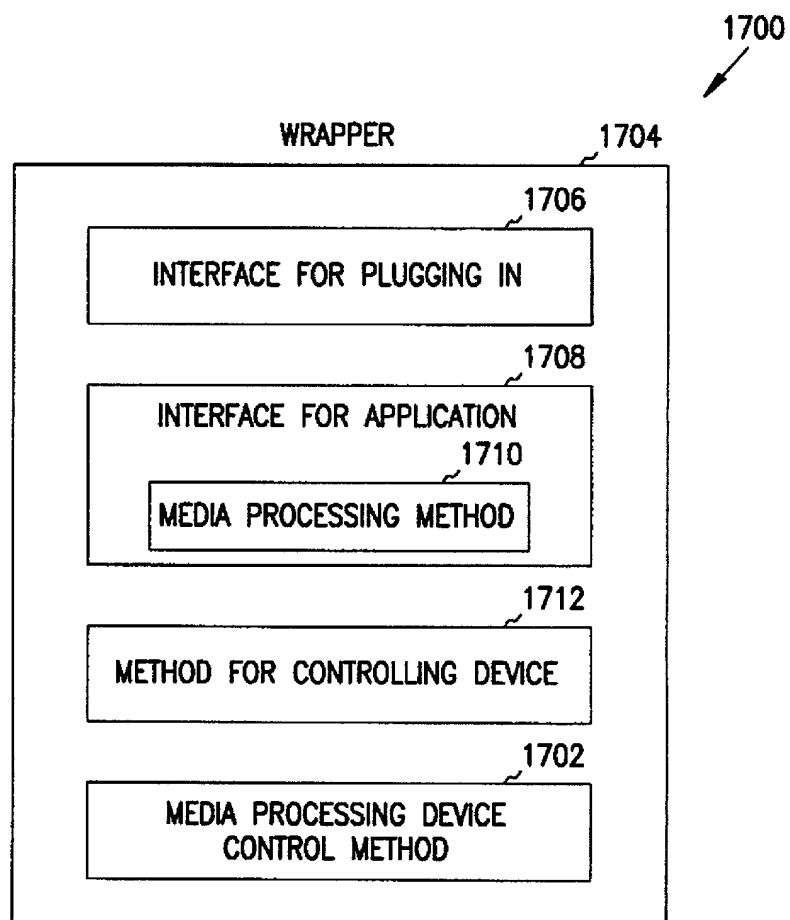


FIG. 17

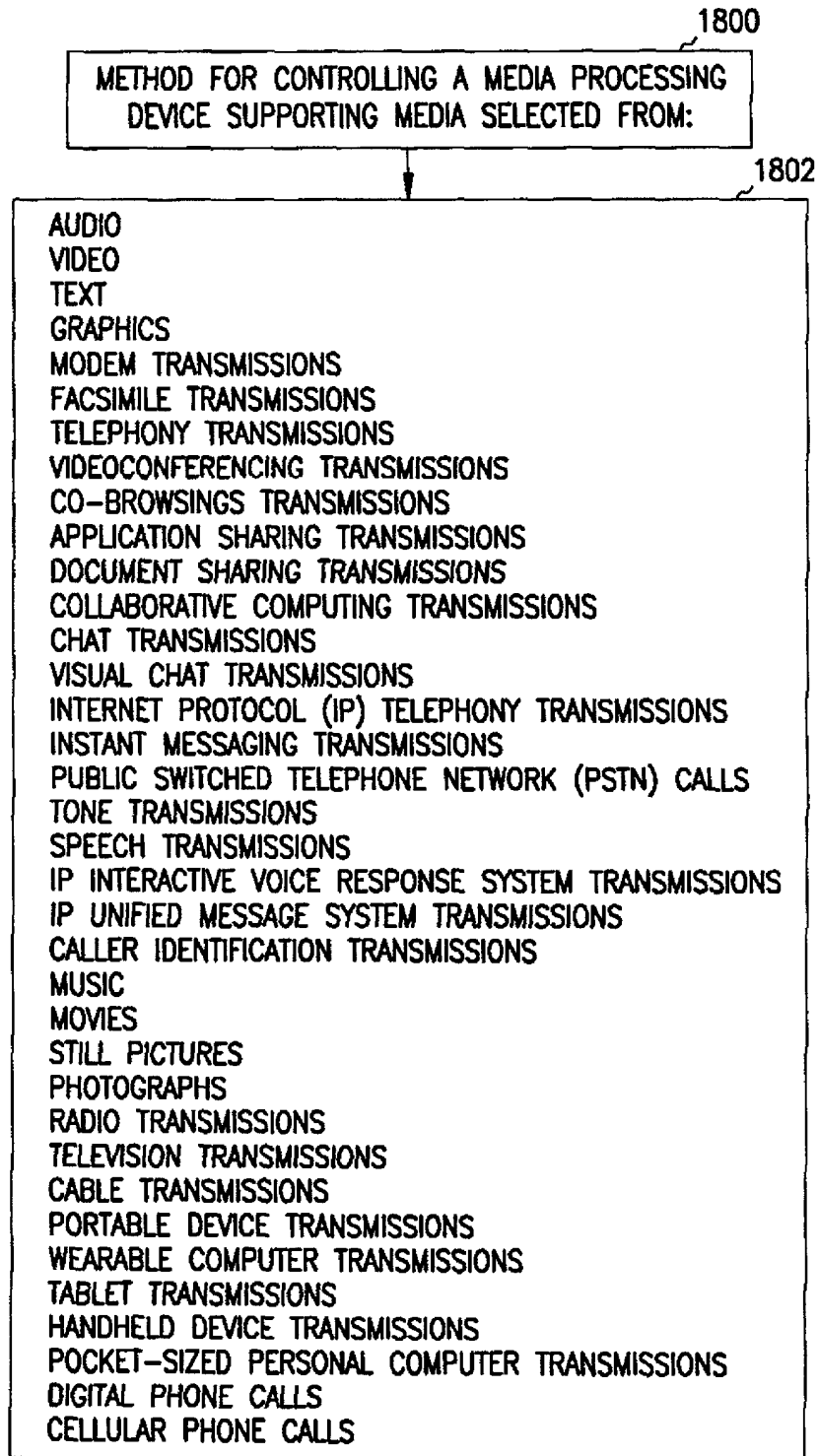


FIG. 18

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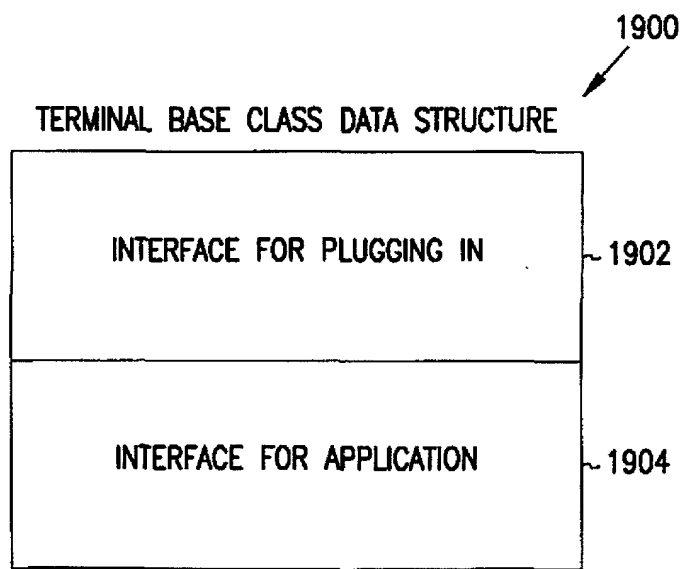


FIG. 19

SCHWEGMAN LUNDBERG WOESSNER KLUTH

United States Patent Application
COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor I hereby declare that: my residence, post office address and citizenship are as stated below next to my name; that

I verily believe I am the original, first and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled: **PLUGGABLE TERMINAL ARCHITECTURE FOR TAPI.**

The specification of which is attached hereto.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with 37 C.F.R. § 1.56 (attached hereto). I also acknowledge my duty to disclose all information known to be material to patentability which became available between a filing date of a prior application and the national or PCT international filing date in the event this is a Continuation-In-Part application in accordance with 37 C.F.R. § 1.63(e).

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on the basis of which priority is claimed:

No such claim for priority is being made at this time.

I hereby claim the benefit under 35 U.S.C. § 119(e) of any United States provisional application(s) listed below:

No such claim for priority is being made at this time.

I hereby claim the benefit under 35 U.S.C. § 120 or 365(c) of any United States and PCT international application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose material information as defined in 37 C.F.R. § 1.56(a) which became available between the filing date of the prior application and the national or PCT international filing date of this application:

Application Number
09/157,469

Filing Date
September 21, 1998

Status
Pending

I hereby appoint the following attorney(s) and/or patent agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith:

Anglin, J. Michael	Reg. No. 24,916	Jurkovich, Patti J.	Reg. No. 44,813	Oh, Allen J.	Reg. No. 42,047
Bianchi, Timothy E.	Reg. No. 39,610	Kalis, Janal M.	Reg. No. 37,650	Padys, Danny J.	Reg. No. 35,635
Billion, Richard E.	Reg. No. 32,836	Kaufmann, John D.	Reg. No. 24,017	Parker, J. Kevin	Reg. No. 33,024
Black, David W.	Reg. No. 42,331	Klima-Silberg, Catherine I.	Reg. No. 40,052	Perdok, Monique M.	Reg. No. 42,989
Brennan, Leoniede M.	Reg. No. 35,832	Kluth, Daniel J.	Reg. No. 32,146	Prout, William F.	Reg. No. 33,995
Brennan, Thomas F.	Reg. No. 35,075	Lacy, Rodney L.	Reg. No. 41,136	Sako, Katie E.	Reg. No. 32,628
Brooks, Edward J., III	Reg. No. 40,925	Lemaire, Charles A.	Reg. No. 36,198	Schumm, Sherry W.	Reg. No. 39,422
Chu, Dinh C.P.	Reg. No. 41,676	LeMoine, Dana B.	Reg. No. 40,062	Schwegman, Micheal L.	Reg. No. 25,816
Clark, Barbara J.	Reg. No. 38,107	Lundberg, Steven W.	Reg. No. 30,568	Scott, John C.	Reg. No. 38,613
Crouse, Daniel D.	Reg. No. 32,022	Maeyaert, Paul L.	Reg. No. 40,076	Smith, Michael G.	Reg. No. 45,368
Dahl, John M.	Reg. No. 44,639	Maki, Peter C.	Reg. No. 42,832	Speier, Gary J.	Reg. No. 45,458
Drake, Eduardo E.	Reg. No. 40,594	Malen, Peter L.	Reg. No. 44,894	Steffey, Charles E.	Reg. No. 25,179
Embretson, Janet E.	Reg. No. 39,665	Mates, Robert E.	Reg. No. 35,271	Terry, Kathleen R.	Reg. No. 31,884
Forденbacher, Paul J	Reg. No. 42,546	McCrackin, Ann M.	Reg. No. 42,858	Tong, Viet V.	Reg. No. 45,416
Forrest, Bradley A.	Reg. No. 30,837	Moore, Charles L., Jr.	Reg. No. 33,742	Viksnins, Ann S.	Reg. No. 37,748
Gamon, Owen J.	Reg. No. 36,143	Nama, Kash	Reg. No. 44,255	Woessner, Warren D.	Reg. No. 30,440
Harris, Robert J.	Reg. No. 37,346	Nelson, Albin J.	Reg. No. 28,650		
Huebsch, Joseph C.	Reg. No. 42,673	Nielsen, Walter W.	Reg. No. 25,539		

I hereby authorize them to act and rely on instructions from and communicate directly with the person/assignee/attorney/firm/organization/who/which first sends/sent this case to them and by whom/which I hereby declare that I have consented after full disclosure to be represented unless/until I instruct Schwegman, Lundberg, Woessner & Kluth, P.A. to the contrary.

Please direct all correspondence in this case to **Schwegman, Lundberg, Woessner & Kluth, P.A.** at the address indicated below:
P.O. Box 2938, Minneapolis, MN 55402
Telephone No. (612)373-6900

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of sole inventor :

Mary Michelle Quinton

Citizenship:

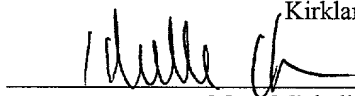
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**7012 120th Ave NE
Kirkland, WA 98033**

Signature:


Mary Michelle Quinton

Date:

8/23/00

§ 1.56 Duty to disclose information material to patentability.

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§ 1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

- (1) prior art cited in search reports of a foreign patent office in a counterpart application, and
- (2) the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and

- (1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or
- (2) It refutes, or is inconsistent with, a position the applicant takes in:
 - (i) Opposing an argument of unpatentability relied on by the Office, or
 - (ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

- (1) Each inventor named in the application;
- (2) Each attorney or agent who prepares or prosecutes the application; and
- (3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.

(d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.